Future Skills Gap Analysis – Renewable Energy Sector

Queensland Government
Department of Energy & Public Works
2022

pwc

Project objective, scope and methodology

In 2022 the Department of Energy and Public Works commissioned PwC Australia to analyse the future skills requirements for the Queensland renewable energy workforce. This document is a high level summary of the detailed report.

Objective

The objective of this report is to identify the future skills requirements in the renewable energy sector in Queensland, including workers across the manufacturing, construction, and maintenance sectors, to inform Queensland Government plans and future policy directions to develop these skills over identified time periods.

Scope

The scope of this summary report is focused solely on the renewable energy sector in Queensland across three time horizons: immediate (2022), medium (to 2032) and long-term (beyond 2032 to 2050).

Methodology

We took the following steps to complete the skills gap assessment:

1

Research:
Given the breadth of new and emerging policy and literature on in-scope industries, we adopted a broad approach to desktop research and analysis. This included review and analysis of national and international reports and policy documents, academic articles, skills frameworks and training pathways.

2

End-to-End Supply Chains and Job Roles identification:
We defined the overall end-to-end supply chain for each industry in scope and, to ensure that 'like' job roles were considered, we adopted the ANZSCO taxonomy to identify job roles for each element of the supply chain for each industry.

3

Transferable skills assessment:
We identified the transferrable skills/general skills that are expected to varying degrees of all occupations. These are likely to transform with technological change and adaption to net zero. We also qualitatively assessed the expected change in required skill level for each job group.

4

Technical skills assessment:
We identified the key technical skills, that is those that are specific to workplace contexts but are also critical to executing tasks in key segments of each industry required for the workforce. This analysis was based on the supply chains, consultation with subject matter experts (SMEs) and desktop research. We assessed the expected degree of change, scope of change and preparedness for change for each skill.

5

Training pathways identification:
We identified the currently available training pathways through the Vocational education and training (VET) and Higher Education systems, and through non-accredited training for each of the technical skills. We completed a qualitative assessment of the adequacy of the existing offerings, in terms of both scope and location.

Key drivers

The energy transition–and the resulting transformation of our workforce, organisations, regional economies and communities–is one of Queensland's greatest challenges and opportunities in the decades to 2050. This transition is taking place in a complex global context of disruptive change arising from major technology, geopolitical and social trends.

Queensland has set bold renewable energy targets for 2030 and aims to achieve net zero by 2050[1]. Energised by these targets and driven by their own ambitions, public and private entities are investing in cleaner energy and creating more jobs for a sustainable and affordable energy future. This report is concerned with the availability of the skills needed to achieve these goals.

Our report identified five **global megatrends that will impact on Queensland's energy industry between now and 2050**, including decarbonisation; a greater focus on environmental, social and governance (ESG) aspects; and further development and integration of industry 4.0 technologies and digitalisation throughout the industry supply chain. These trends will **create opportunities and challenges** for the industry, which will in turn will impact on the skills and knowledge required by its workforce, both now and in the future.

Queensland's highly skilled workforce, efficient infrastructure, ports and industrial land located in regional centres **all put Queensland in a position to lead the way on renewables**. However, importantly some regions (e.g. Central Queensland and Darling Downs – Maranoa) will likely be more impacted than others, and so it is critical to avoid a uncoordinated transition and any potential negative social and community consequences.

To effectively address these challenges and position Queensland's workforce to capitalise on current and future opportunities, we need coordinated action from the Government, industry, the education and training sector, and local communities. Ensuring Queenslanders have the skills and capabilities needed for the development of a diverse, future-state energy industry, is the **foundation of our future successful state and regional economies**.

Five global megatrends

Technological breakthroughs
Industry 4.0 practices and other technological advances are forcing workers to reskill and redeploy to other job roles.

Climate change and resource scarcity
Accounting for two-thirds of global GHG emissions, the energy industry is at the forefront of the decarbonisation pathway, with increasing demand for renewable energy solutions.

Demographic and social change
An ageing Queensland workforce means that there is a need to build strong domestic pipelines of skilled workers.

Shift in global economic power
Demand for critical minerals and strong hydrogen export opportunities with will shape industry activity and workforce skills required.

Rapid urbanisation
Rapid urbanisation will shift workforce trends towards metropolitan areas and increase the uptake of remote working arrangements.

15,000
Queenslanders directly employed in electricity generation, transmission and distribution[2]

6,000
direct and indirect jobs engaged in the overall renewable energy sector supply chain in Queensland[3]

86%
of the Queensland clean energy workforce was involved in manufacturing, development, construction, or installation of renewable energy projects in 2020[4]

2,710
full time equivalent jobs in the renewable energy industry across the state[5]

1. This report was initially completed by PwC Australia in May 2022 and does not reflect public announcements and policy changes that have taken place since then, including the new targets of 70% renewable energy by 2032 and 80% by 2035 defined in the Queensland Energy and Jobs Plan (2022). Energy Networks Australia, "Electricity Network Transformation Roadmap: Future Workforce Skilling Impacts", (2017); 3. Clean Energy Council, "Clean Energy at Work in Queensland", (2020); 4. Clean Energy Council, "Clean Energy at Work in Queensland", (2020); 5. Clean Energy Council, "Clean Energy at Work in Queensland", (2020).

Industry and workforce trends

Several energy industry and workforce-specific trends will affect the ability for Queensland and Queenslanders to adapt successfully to the changes, taking account of the transition timelines and the availability of people and training pathways in impacted regions.

Workforce trends

Certain professions will be most impacted by changes in skills

Distributed energy resources (DER) and other distributed networks will require engineers, technicians and tradespersons to develop greater digital and data literacy to grapple with the complexity of these systems.

Automation and grid infrastructure will have the biggest impact on skills needs

There are existing grid and commissioning project skills shortages, which will continue to be in demand for the next 10 years. Other technical skills related to emerging forms of renewable technology such as battery energy storage, pumped hydro energy storage, and operational technologies in DER will be in high demand.

Energy transition in the next 10 years faces blockers for key skills

The existing workforce for renewable energy technologies is small and there are long lead times for training workers. This could limit the pace at which renewable energy projects can be delivered. However, it also means that there are opportunities to transition workers from fossil fuel activities to these projects with minimal reskilling and support jobs in regions.

Central Queensland, Darling Downs-Maranoa and Mackay-Isaac-Whitsunday will see major growth

These regions will see growth in the number and variety of renewable energy projects established due to favourable locations and existing or candidate Renewable Energy Zones. Some of these projects may demand niche skills not commonly available in Australia, such as pumped hydro maintenance or large-scale battery installation.

Training pathways may need adapt to address new skills

Skills in automation, operational technologies & managing community impacts are partially addressed by the content of existing nationally accredited training pathways. But they are likely to require review and updating in the future as their technological complexity increases.

Energy industry trends

Focus on the energy sector will continue for the foreseeable future because Queensland's electricity sector accounts for 30% of Queensland's total greenhouse emissions. Higher community expectations around ESG, social license and energy efficiency will drive decarbonization through to 2050.

Power generation is being transformed from a top-down centralised system to one that is much more decentralized, digitalized and diverse, comprising a broader range of variable renewable energy sources. The future energy system will be more financially and operationally complex than before.

Net zero targets are driving rapid transformation in power and utility businesses. The change in the energy generation mix is key to this, with most scenarios projecting ongoing growth for renewables and earlier timelines for closure of fossil fuel generation, particularly coal.

Electrification of industry (partly through hydrogen), household cooling, transportation including Electric Vehicles (EV) will lead to a production gap of green energy when related to global energy demand. These trends will reopen discussions on energy dependency and independence.

Technological innovation is at the heart of the shifts that are occurring in the power sector in response to the need to balance decarbonization with reliability and affordability. Technology breakthroughs, for example in the cost and practicality of battery storage technology, will have significant impacts.

Demand for skills will increase for both qualified and higher skilled roles in this sector as decarbonization occurs and new renewable energy generation sites are brought on-line. The next 30 years may see the creation of direct jobs in renewables, with renewables requiring lower labour intensity per MW than fossil fuels.

Smart grids are delivering the potential for greater interactivity with customers through a combination of the internet, mobile devices, data analytics and cloud computing with smart grids and smart metering.

Transferable and technical skills changes to 2050

The impacted skills can be classified into two broad families: transferable skills, which are common across many industries and are driven by the five megatrends; and technical skills, which are more closely aligned to the energy transition and resulting transformation of the workforce.

Transferable skills

Four key skills that will be required:

Problem Solving and Systems Thinking
Problem Solving and Systems thinking will be increasingly prominent in the workforce and be responsible for designing, commissioning, operating and maintaining assets as the transformation to renewable energy accelerates, DER becomes more commonplace, automation is more widespread and overall system operations become increasingly complicated and complex.

Digital and Data Literacy
With the industry shift to real time data, and use of artificial intelligence (AI) and machine learning to automate or support decision making, numeracy, digital and data literacy will become core skills to many workers across the renewable energy value chain rather than specialised skill sets held by a few.

Client Services
Client Services will become more prominent with the full shift to customer centric thinking across the value chain, increased customer demand for access to data and decision-making, the proliferation of DER and the move to customers wanting to trade the power they generate. In addition, there will be a growing need for stakeholder engagement thought an asset's lifecycle, not just in the concept and construction stage as communities become more informed and more actively engaged with the industry.

Innovation and R&D
Innovation and R&D will be crucial to making the energy transition and workforce transformation successful in the long term with the need for innovation to be a core skill to ensure businesses keep pace with the rapidly changing industry in a prudent, efficient and sustainable manner.

Technical skills

Four key skills where the rate and scope of change is fast and wide:

Overseeing grid connection and integrating DER/smart grid systems
By 2032, there is an expected increased prevalence of customer battery storage and EVs and a fundamental shift in how customers utilise and manage their energy use. The rise of the prosumer[1] means that micro-grids and smart grids will become the norm and the skills required to develop such systems will be in high demand.

Understanding of and working with automation
Systems and equipment that involves electronics, automation, internet of things (IoT), AI and big data becomes the industry standard/norm. As distribution networks increase geographically, further technological development and innovation will be required along with locally skilled workforces.

Working with Operational Technology (OT)/Information Technology (IT) linkages
Digitalisation and Industry 4.0 technologies will continue to roll out across the renewable energy supply chain and become commonplace by 2050. There will be an increased focus on environmental impacts and social licence to operate, driving innovation and R&D with respect to OT and IT. The workforce will need to be trained and experienced in technologies and OT/IT integration and linkages.

Knowledge of effective cyber security practices and procedures
With existing shortages and an increase in cybersecurity risks as energy systems and equipment become fully interconnected, there will continue to be high demand for skilled workers in cybersecurity.

1. A new paradigm for utilities: the rise of the "prosumer" (https://reneweconomy.com.au/new-paradigm-utilities-rise-prosumer-26384/)

Key findings - critical skills

The report identified several critical skills that are either in particularly short supply in the required regions, or facing significantly high demand, or more commonly both.

Electrical commissioning and installation for REZs

- **Electrical commissioning and substation isolation and installation** will be required **wherever there are new renewable energy generation sites**. These skills are critical to extending the transmission network required to connect these assets to the grid.
- This skill is already in high demand and short supply, a situation which will worsen unless steps are taken now to bring more workers into associated roles (eg line workers).
- These skills are and will be required in every region to some extent.

Labour demand for Pumped Hydro Energy Storage

- Development, construction and operation of **pumped hydro energy storage (PHES) schemes will require a significant number of workers** during the construction stage, several orders of magnitude greater than required for operation, and an ongoing skilled workforce to operate these schemes.
- PHES is an area in which there is very little existing skill set within Australia and this shortfall could prevent these schemes progressing within desired timeframes.
- These skills are required particularly in Wide Bay-Burnett where the 2GW Borumba Pumped Hydro system is expected and in Mackay-Isaac-Whitsunday.

Grid-scale battery energy storage systems

- Installing and maintaining grid scale **battery energy storage systems is a skill that is currently not commonly found in Queensland**, or even more widely across Australia.
- This skill will be critical to firming renewable energy generation as it increases its share of overall energy supply in Queensland.
- These skills will be required in the Brisbane, Central Queensland, Darling Downs/Maranoa, Mackay-Isaac-Whitsunday, Toowoomba, Townsville and Wide Bay regions through to 2032 and 2050.

Operating and planning power networks

- **Operating and planning power networks** and the other technical skills identified will be required across a wider range of assets, a greater geographical area and be increasingly complex as a result of both Industry 4.0 trends.
- There is a good basis to build these skills through **existing training pathways and with the existing skilled workforce**. This workforce needs to be greatly increased into the future but are presently not identified as having critical shortages.
- These skills are again required in every region to a greater or lesser degree but are currently likely to be concentrated in the Brisbane region.

Key findings - training pathways

The report also examined the availability of training pathways for critical skills in the required regions. The key findings are summarised below.

1. There is an **existing workforce and knowledge base for many of the renewable energy technical skills**, however through to 2032 there are expected to be **rapid technological changes** in digitalization, **increased activity** due to the energy transformation, and **increased complexity** from diversified energy generation types and locations.

2. **Merging of disciplines** is occurring, and will continue, as the industry transforms and will require a shift in thinking in design of pathways for all workers ensuring continuous professional development pathways, including micro-skilling, is available.

3. However, the **location of currently available training is limited** to:
   - South East Queensland, mainly Brisbane, and
   - Toowoomba for a limited amount of relevant educational pathways.

4. There will be a need to create new and update current training products to prepare workers for an increased variety of generation technologies, network devices and device automation, and their cyber requirements.

Skills requiring further representation in training pathways

Considering the VET, Higher Education and other non-accredited pathways, there are suitable existing courses for all skills except:

Overseeing grid connection and integrating DER and smart grid systems	Partially available in existing training pathways for some technologies
Installing and maintaining battery energy storage systems (BESS)	Partially available in existing training pathways (only for distributed PV solar systems)
Understanding of and working with automation	Partially available in existing training pathways but contextualization to energy may be required
Working with Operational Technology/ Information Technology linkages	Partially available in existing training pathways
Knowledge of effective cyber security practices and procedures	Partially available in existing training pathways but contextualization to energy may be required
Managing the environmental, community and heritage impacts of renewable energy and transmission project delivery and ongoing operations	Partially available in existing training pathways (environmental impacts are well covered, but heritage and community are not)

Key findings - gaps, blockers, opportunities and enablers

There are several other characteristics that will either help or hinder Queensland's ability to meet the future workforce needs. These relate to non-workforce specific aspects, such as long lead times; the ability to leverage remote communications technologies for both training and service delivery; and demographics and levels of community acceptance.

Transmission line and substation workforce

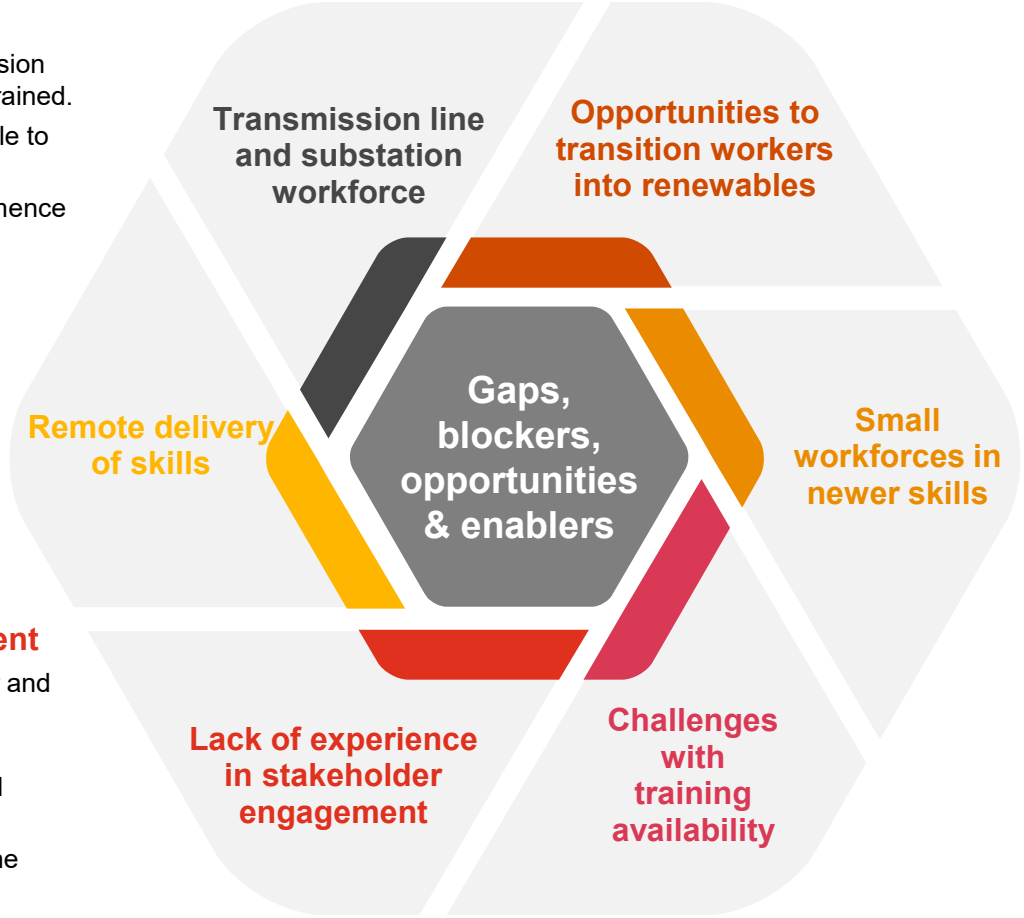
- Construction and commissioning workers for transmission lines and substations take at least 4 years to be fully trained.
- Overseas resources require at least one year to be able to work independently in Australia.
- Recruitment and training of these people should commence immediately to meet current and forecast demand.

Remote delivery of skills

- Many skills in the energy industry can be delivered remotely or through other hybrid working arrangements, eg energy trading, planning and operating networks, and other technology focused skills.

Lack of experience in stakeholder engagement

- There is a current skills gap in meaningful stakeholder and community engagement.
- These skills will be crucial as renewable project sites become more prominent to ensure that a lack of social license does not block progress.
- Without sufficient social license, projects can stall at the EIA (environmental impact assessment) stage.



Opportunities to transition into renewables

- Increase in renewable energy generation locations provide opportunities for workers to transition from adjacent industries, such as in fossil fuels.
- These opportunities can require minimal reskilling in some cases or upskilling of workers in more remote regions of Queensland.

Small workforces in newer/emerging skills

- There are small existing workforces in some newer or emerging skills, such as DER, BESS, PHES and energy trading.
- These are also the skills with the fastest expected rate of change – training and other upskilling opportunities need to be provided to ensure skilled workers are available when required through the next 10 years.

Challenges with training availability

- There is a lack of currently available training in VET, higher education and non-accredited pathways in the regions with current or proposed REZs.
- In remote regions there are other potential challenges with attracting trainers and workers to live and work in these regions, some of which are facing ageing population pressures.

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