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Electricity Workforce Projections for the 2024 Integrated System Plan: Focus on Queensland

Final Report

UTS Institute for Sustainable Futures

AEMO

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

Final report

RACE for Change

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RACE for 2030

Project partners

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Acknowledgement of Country

The authors of this report would like to respectfully acknowledge the Traditional Owners of the ancestral lands throughout Australia and their connection to land, sea and community. We recognise their continuing connection to the land, waters, and culture and pay our respects to them, their cultures and to their Elders past, present, and emerging.

What is RACE for 2030?

Reliable, Affordable Clean Energy for 2030 (RACE for 2030) is an innovative cooperative research centre for energy and carbon transition. We were funded with $68.5 million of Commonwealth funds and commitments of $280 million of cash and in-kind contributions from our partners. Our aim is to deliver $3.8 billion of cumulative energy productivity benefits and 20 megatons of cumulative carbon emission savings by 2030. racefor2030.com.au

Disclaimer

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List of abbreviations

Acronym	Term
AEMO	Australian Energy Market Operator
FTE	Full-Time Equivalent
GW/GWh	Gigawatt / Gigawatt Hours
ISF	Institute for Sustainable Futures
ISP	Integrated System Plan
MW	Megawatt
NEM	National Electricity Market
O&M	Operations & Maintenance
PV	Solar Photovoltaic
REZ	Renewable Energy Zones

1 Introduction

This report provides projections for the electricity sector workforce in Queensland. It is part of a wider study[1] that looks at the projected electricity workforce requirements associated with the Australian Energy Market Operator's (AEMO) 2024 Integrated System Plan (ISP).

Projections cover the workforce needed to build and operate the generation and storage infrastructure and construct the new transmission lines included in the Queensland for the ISP.

The project was conducted by the Institute for Sustainable Futures, University of Technology (ISF) in partnership with AEMO and funded by the RACE for 2030 Cooperative Research Centre. An Industry Reference Group made up of representatives from state government, industry and peak bodies, provided valuable insights.

The aim of this report is to provide stakeholders with an in-depth understanding of the workforce implications of different electricity scenarios, with a specific focus on Queensland. This report develops workforce projections broken down by technology, occupation and location, for each of the ISP's three scenarios.

The ISP's three scenarios (or optimal development paths) reflect various policy and market contexts on the path towards net zero by 2050. All scenarios comply with all existing state and federal legislated targets and consider state and federal energy policies. The scenarios are:

- **Step Change** includes a rapid pace of energy transition with strong economic growth and with Consumer Energy Resources (CER) playing a strong role. It supports Australia's commitment to keep global temperature rise to below 2°C.
- **Progressive Change** reflects a constrained economic and supply chain environment meaning less uptake of CER and deployment of utility-scale developments. as less energy is required to meet the needs of a smaller economy. While meeting legislated commitments, cumulative electricity sector emissions to 2050 are 36% higher than under the Step Change.
- **Green Energy Exports** indicates an exceptionally fast rate of decarbonisation aimed at Australia making its contribution to keeping global temperature increase to below 1.5°C, with a strong emphasis on a green exports economy and electrification. Cumulative electricity sector emissions to 2050 are 46% reduced compared to the Step Change.

After extensive consultation with a wide range of stakeholders, AEMO has determined that the most likely scenario is Step Change (43% likelihood), followed closely by Progressive Change (42% likelihood), with Green Energy Exports assigned a likelihood of just 15%.

[1] Rutovitz, J., Gerrard, E., Lara, H., and Briggs, C. (2024). The Australian Electricity Workforce for the 2024 Integrated System Plan: Projections to 2050. Prepared for RACE for 2030. www.uts.edu.au/isf/explore-research/projects/australian-electricity-workforce-2024-integrated-system-plan-projections-2050

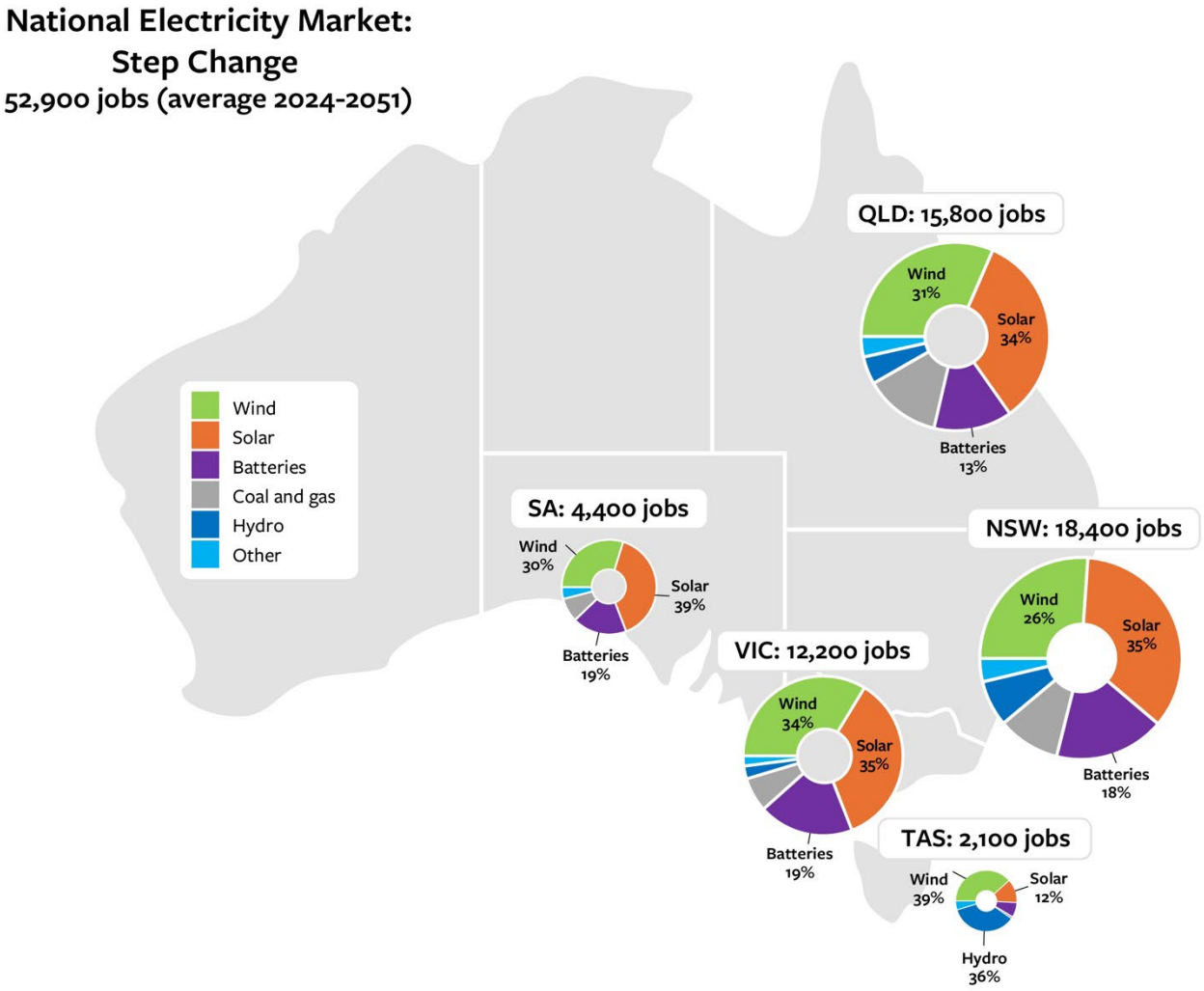

Figure 1 Average electricity sector jobs by State, 2024-2050 (Step Change)

Under the Step Change scenario, Queensland averages 15,800 jobs in generation and storage or transmission line construction from 2024-2050. Queensland contributes just over a third of the total electricity sector workforce in the National Energy Market (NEM) (Figure 1).

New South Wales is the leading state under the Step Change, averaging 18,400 full-time jobs per year, followed closely by Queensland (15,800). Victoria is some way behind with 12,200 jobs on average. Solar and wind account for between 61% and 69% of jobs in all states except Tasmania, where hydro and wind account for 75% of jobs.

In the Green Energy Exports scenario, the highest number of jobs are created in Queensland (32,400 on average), followed by New South Wales (22,600) and Victoria (15,900).

See the main report, *The Australian Electricity Workforce for the 2024 Integrated System Plan: Projections to 2050* (Rutovitz et al, 2024) for details on the methodology including a full list of employment factors, results for the NEM as a whole, a comparison of results by State, and recommendations for further work to support planning for workforce development.

There is also a downloadable workbook of the results for each state and for the NEM. www.uts.edu.au/isf/explore-research/projects/australian-electricity-workforce-2024-integrated-system-plan-projections-2050

2 Workforce projections for Queensland by scenario

Electricity sector workforce projections for Queensland are shown for all scenarios in Figure 2. Employment initially peaks close to 2030 (2031 in Green Energy Exports) in all scenarios, reflecting Queensland's legislated emissions reduction target of 75% reduction in 2005 by 2035[2]. There is a general trend upwards to the early 2030s, followed by sharp workforce reductions. In the Step Change and Progressive Change, workforce requirements plateau until the late 2030s and then rise slowly again. In Green Energy Exports, workforce growth is more volatile through the 2030s, followed by exponential growth in the 2040s.

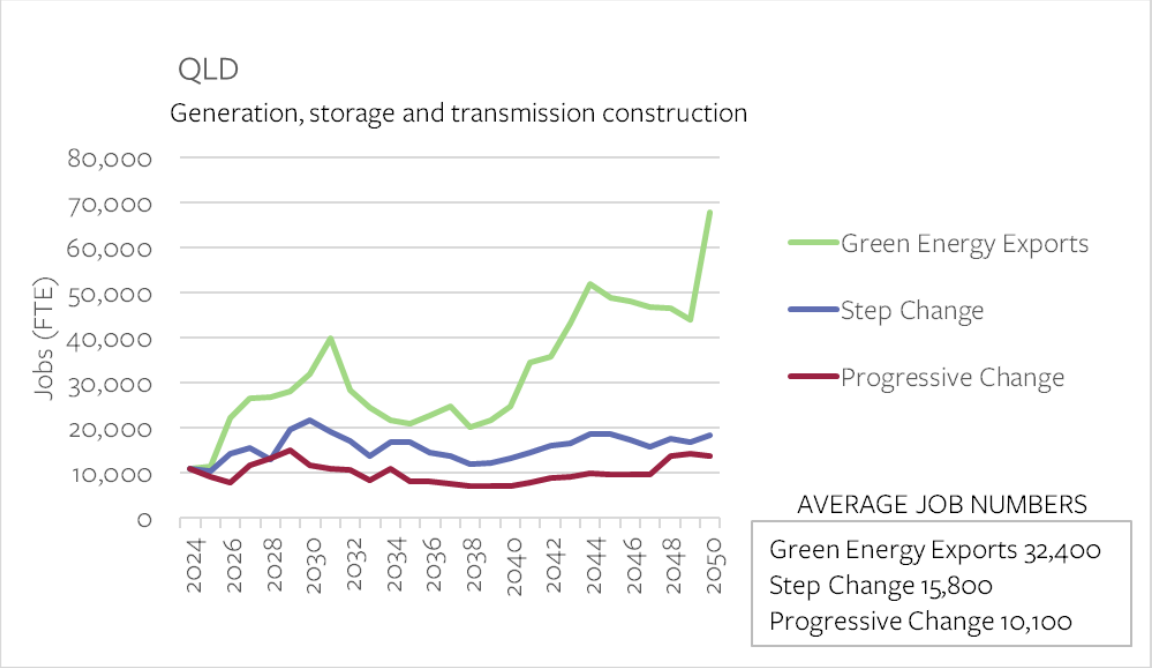

Figure 2 QLD, electricity sector jobs by scenario

- Under the Step Change scenario, there is an average of 15,800 jobs from now to 2050. The workforce almost doubles by 2030, starting out at 11,000 jobs and reaching 21,700, an increase of 10,000 jobs in five years.
- Under the Green Energy Exports scenario, jobs average 32,400 from now to 2050. There is exponential job growth to the first peak in 2031, with 28,700 jobs added in seven years, a total peak of 39,700. Jobs then fluctuate significantly, going sharply down to 20,900 by 2035 (a loss of just under 20,000 jobs over five years). From the late 2030s jobs increase exponentially to reach nearly 70,000 by 2050, and addition of 50,000 jobs over 10 years.
- Under the Progressive Change scenario, annual electricity sector employment sits at 10,100. The workforce peaks in 2029 with a total of 15,100 jobs. It then drops to 11,000 by 2031 and plateaus till the early 2040s, after which it rises slowly.

***Total jobs**: when we talk about the number of jobs in this report, we mean the number of full-time equivalent (FTE) positions for each year. These are the sum of people working on construction projects, operations and maintenance, manufacturing (as it relates to the energy sector), and fuel supply for coal and gas generation in that year. One FTE could be one person working full time, two people working full time for six months, or an ongoing full-time job in operations and maintenance. Construction jobs are temporary by nature, although workers may move from one project to another and be in continuous employment.*

[2] Queensland Government, Department of Energy and Climate, Clean Economy Jobs Act 2024

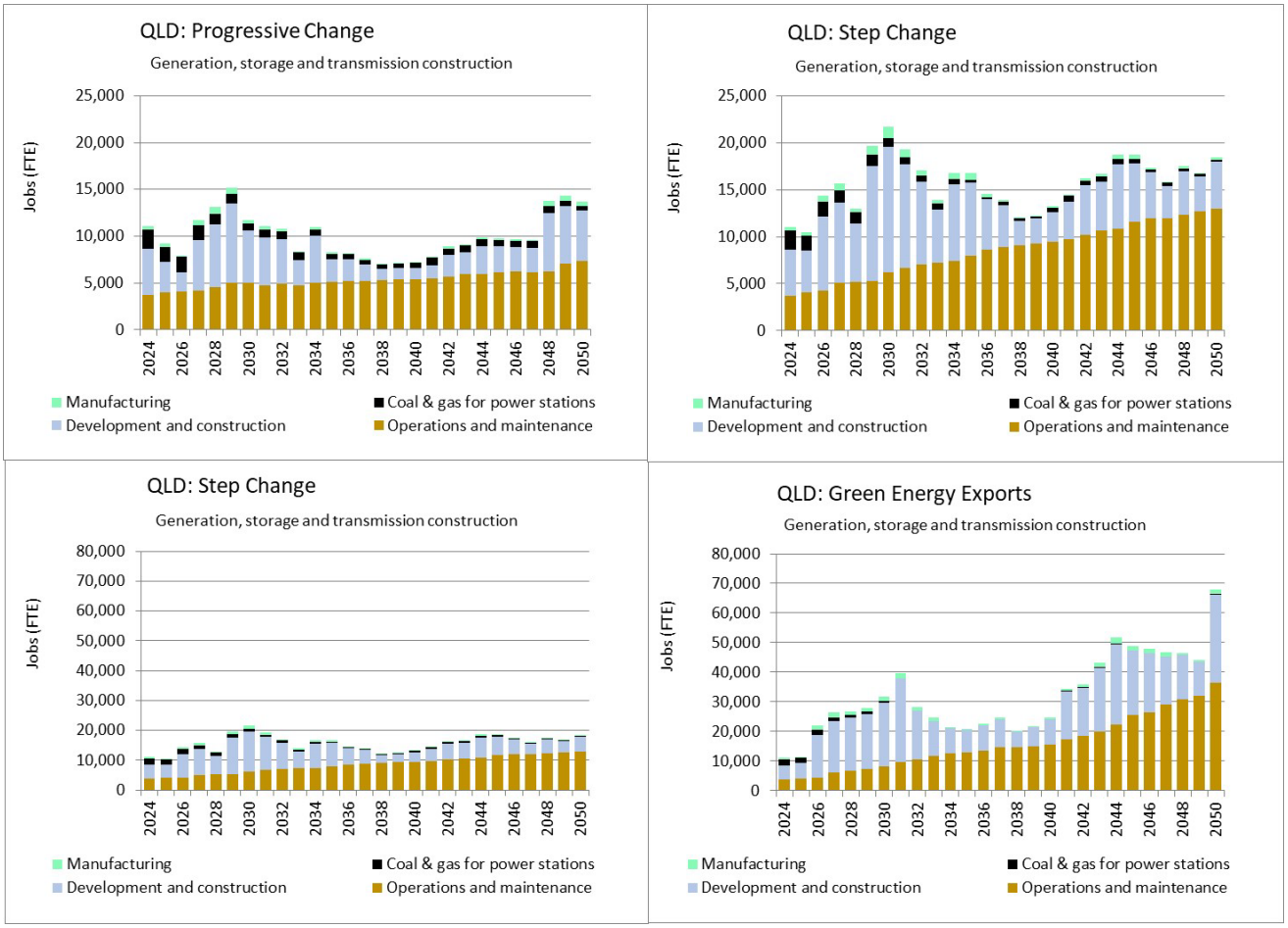

Figure 3 QLD, jobs by phase (all scenarios)

Note: The scales are 0-25,000 on the top graphs and 0-80,000 on the bottom graphs.

Figure 3 shows the total employment by project phase, from manufacturing to development and construction, operations and maintenance, and in fuel supply jobs for coal and gas power generation. The top two graphs show Step Change compared to Progressive Change, while the bottom graphs show Step Change compared to Green Energy Exports. Under all scenarios, development and construction jobs dominate in the next five years. This gradually switches to operations and maintenance roles, which overtake construction in the mid-2030s. The steady growth in operations and maintenance (O&M) jobs under all scenarios results from the increased fleet of renewable energy and storage projects coming online.

By 2050 under Step Change, O&M represents 71% of the total electricity sector workforce, and 54% under the other two scenarios. The O&M workforce will be servicing not only utility-scale developments, but also the growth in rooftop solar and distributed batteries.

In Figure 4, jobs are shown according to technology group for each scenario. The breakdown covers renewables, storage, transmission construction and coal and gas. Under all scenarios, renewables account for the largest share of jobs.

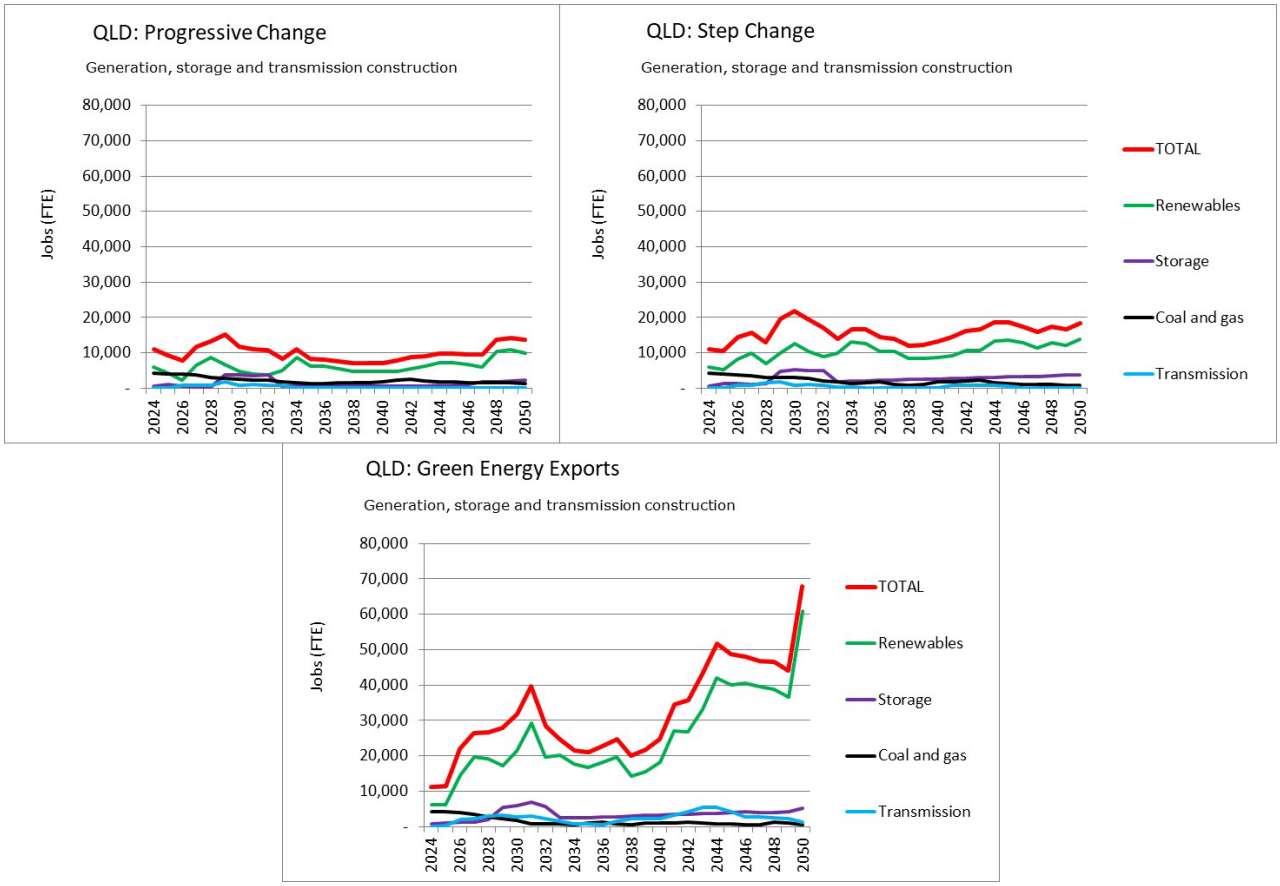

Figure 4 QLD, jobs by technology group (all scenarios)

3 Employment by occupation for Queensland

When it comes to planning for the energy transition, occupational employment trends – the type of jobs required – provide government, industry, the training sector, and the community with vital insights. This information can inform policy design, education and training packages, as well as individual employment pathways.

Figure 5 illustrates the average per annum employment demand from 2024 through to 2041 in terms of occupational structure (employment grouping) for the Step Change scenario. It includes generation technologies and the construction of transmission lines but does not include employment in batteries. Employment in batteries is not included because we do not have sufficient employment factor data for projections due to the emerging nature of the technology. Importantly, solar represents both rooftop and utility-scale.

- For Queensland, the occupational group with highest number of jobs is trades and technicians, with an average of 4,500 jobs. Wind is the dominant technology, accounting for over half of the trades and technician workforce.
- Following trades and technicians is the professional workforce, which includes occupations such as engineers, finance, stakeholder and community engagement professionals. The professional workforce averages 2,400 from now until 2041.
- Managers average 2,100, driven in large part by the demand for construction managers in the build out of renewable energy infrastructure.
- Labouring jobs average just under 1,700 from now to 2041. These jobs will largely consist of construction labourers, with pumped hydro the dominant technology, accounting for nearly half of the workforce. Machine operators (such as truck drivers and crane operators) average 1,200 jobs in the Step Change scenario, with coal and gas still contributing significantly to demand. Lastly, an average of 900 administrative jobs will be required under the Step Change scenario.

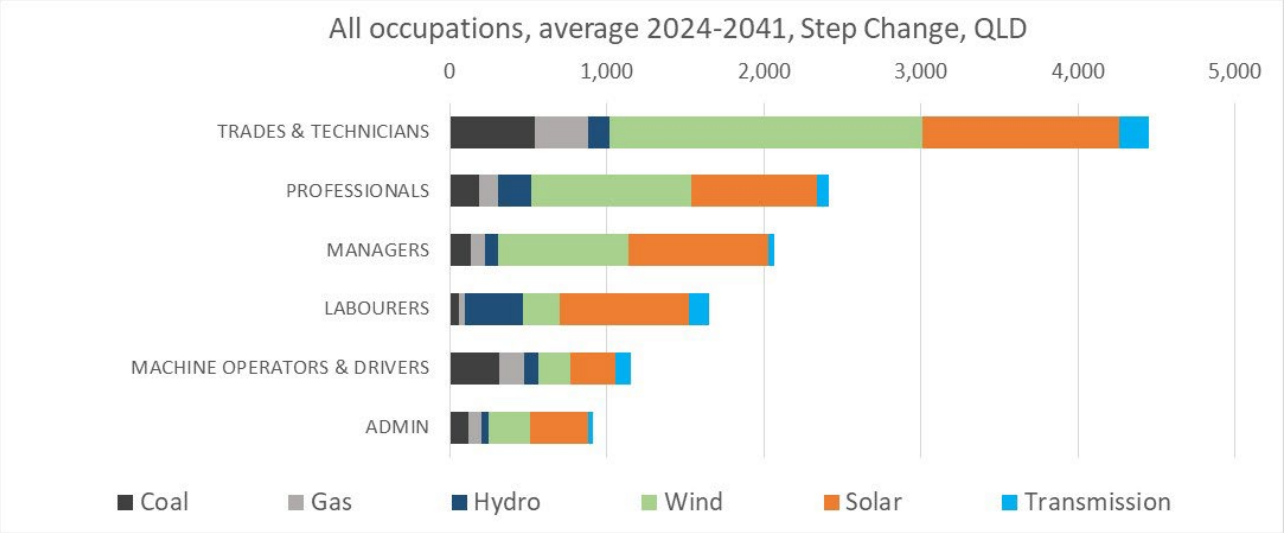

Figure 5 QLD, average occupational structure (Step Change)

To effectively manage the labour supply and the requisite skills and training, the peaks in employment are the most significant. For Queensland, 2030 is the peak year for electricity sector employment in the period to 2041 under Step Change. The peak year is similar in Progressive Change and Green Energy Exports, which peak in 2029 and 2031 respectively (see Appendix A). The labour requirements under the Step Change scenario for the peak year for energy sector employment in Queensland are shown in Figure 6.

Under Step Change, electricians are in high demand in 2030, with 2,300 electricians needed, with the wind sector making the bulk of demand. This is followed by demand for 1,200 construction labourers under Step Change in 2030, mostly required for pumped hydro construction. Admin staff and roles such as finance, business, legal and policy professionals, both require just over 1,100 jobs in the peak year under Step Change.

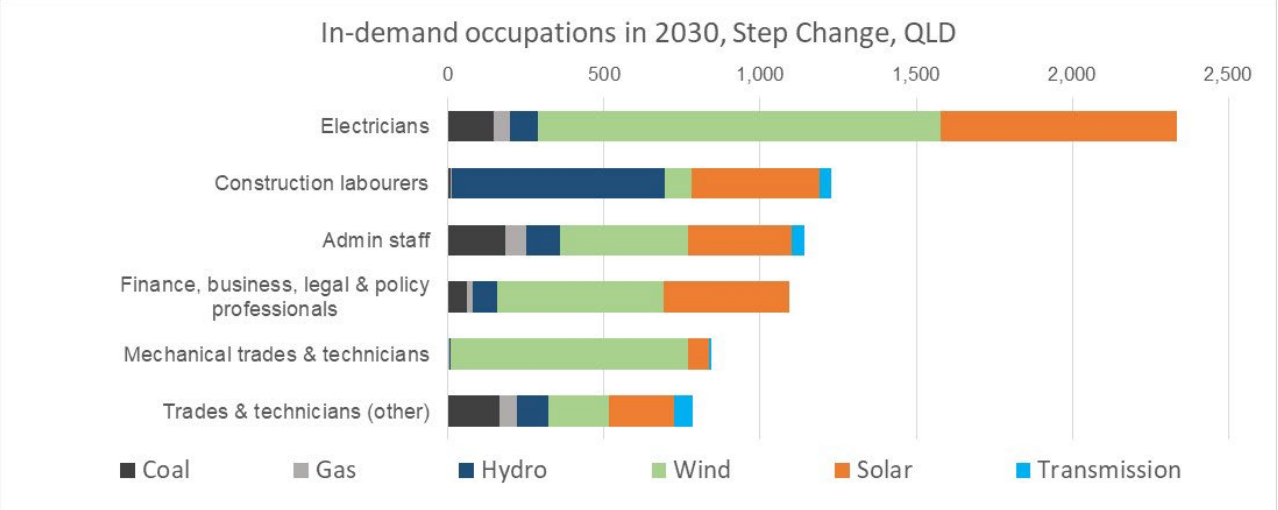

Figure 6 QLD, in-demand occupations during peak year (2030)

Figure 7 shows the six most in-demand occupations by technology for the period 2024-2041 under Step Change. Electricians and administrative staff dominate, growing consistently over the period. Construction labourers follow a more volatile profile, with peaks in demand in 2029-2032, before dropping off and fluctuating below 800 jobs till 2041. Demand for mechanical trades and technicians grows steadily, with the wind sector needing the most workers.

Figure 7 QLD, in-demand occupations annual requirement by technology, Step Change

Note: Electricians and admin staff have a scale reaching 3,500 jobs, whereas other occupations have a scale reaching only 1,600.

4 Workforce projections by technology for Queensland

Queensland is set to see significant employment growth in the wind sector and rooftop solar under all scenarios, with very strong growth in utility solar under the Green Energy Exports scenario. Figure 8 shows the average electricity sector jobs under each scenario, broken down by technology. Figure 9 shows the annual workforce requirements and gives a more detailed technological breakdown.

- Rooftop PV and distributed batteries draw from the same workforce, with installers working across both technologies. Combined, this sector accounts for between 22% and 36% of average employment in all scenarios.
- Under all scenarios, employment in wind makes up 32% or more of the average electricity sector employment profile.
- Utility-scale solar accounts for an average of 9%-25% of total electricity sector employment.

These projections include repowering for wind and solar, assuming that wind turbines are replaced after 25 years, utility solar after 30 years, and that 80% of rooftop solar is replaced after 25 years. Repowering refers to the process of replacing hardware due to end of life or because improvements in the technology have significantly enhanced performance, meaning it is more profitable to do so. Any employment associated with recycling of materials or mineral extraction (other than coal and gas for fuel) is not included.

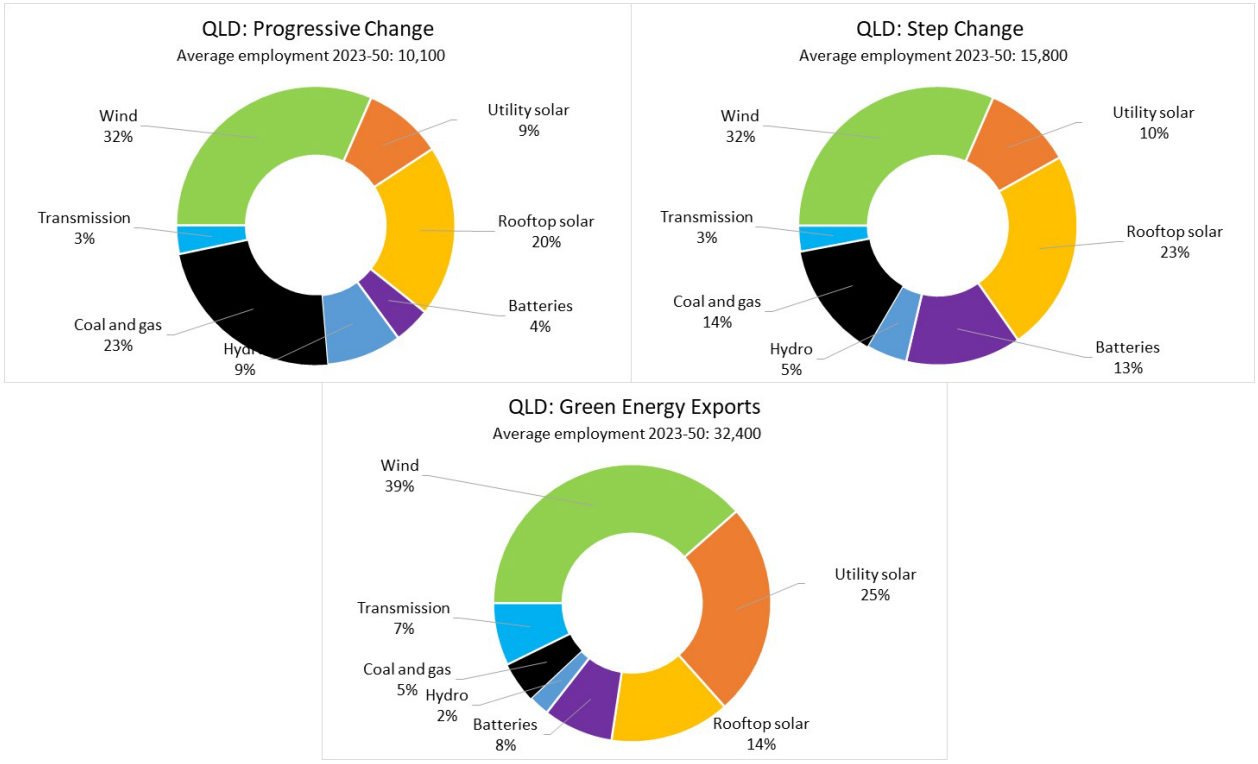

Figure 8 QLD, average electricity sector jobs by technology and scenario

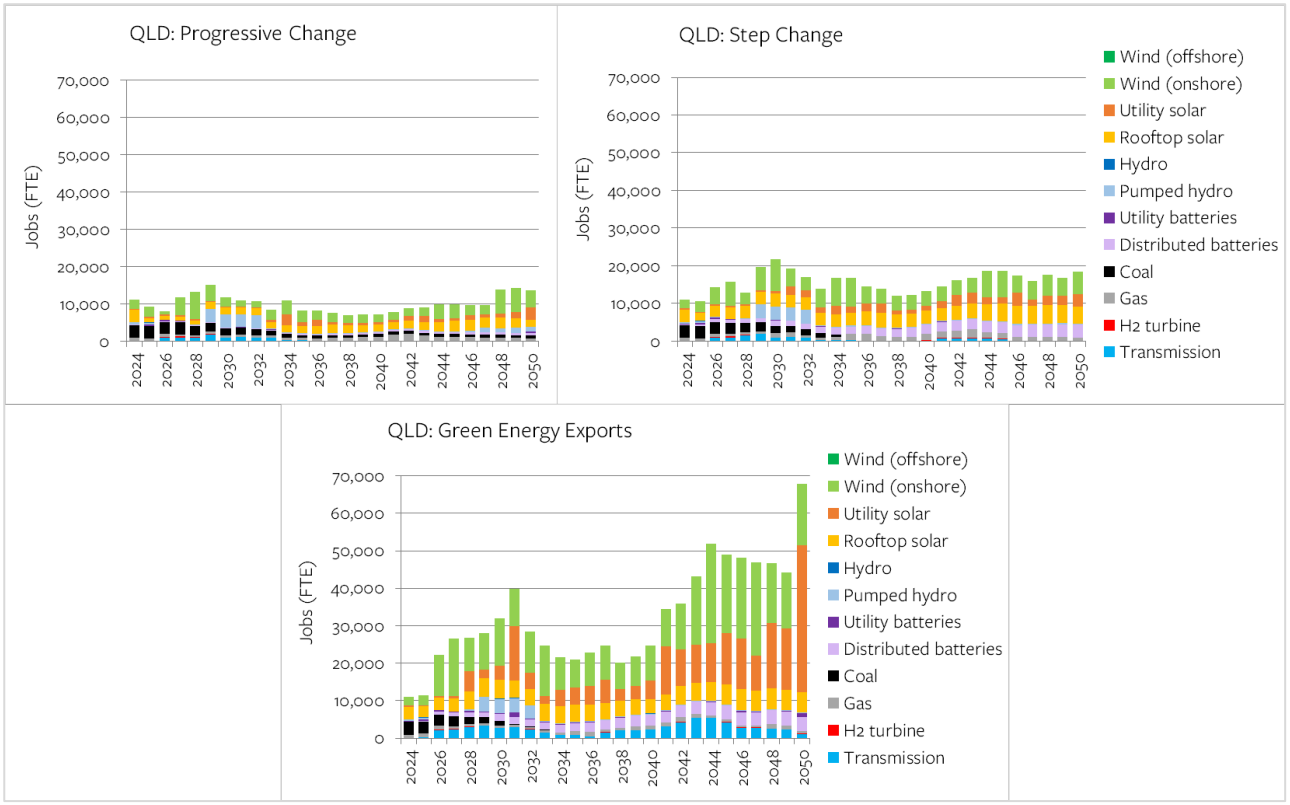

Figure 9 QLD, jobs by technology (all scenarios)

4.1 Wind

Employment in the wind sector in Queensland is shown in Figure 10. Under the Step Change, wind averages 5,000 jobs over the period. Under Progressive Change, average employment is lower, at 3,200. Under Green Energy Exports, the average workforce is 12,500, between two and four times higher than the other scenarios. For Queensland, offshore wind does not feature under any scenario.

Repowering starts in the 2040s across all scenarios, although overall numbers are small. Wind repowering averages between 200 and 300 jobs in Queensland during the 2040s.

Under all scenarios, significant sector growth occurs in the lead up to 2030. During the 2030s, jobs drop off and remain low under Progressive Change (a drop of 4,800 jobs between 2028 and 2030). Under Step Change the employment profile is volatile from now until 2036, with a workforce peak of 8,400 in 2030. Under Green Energy Exports and Step Change, there is a second boom in demand in 2033 and 2034. In Green Energy Exports, the 2040s see a massive expansion of capacity, accompanied by more than quadrupling the workforce, which ranges from 15,000 to 25,000.

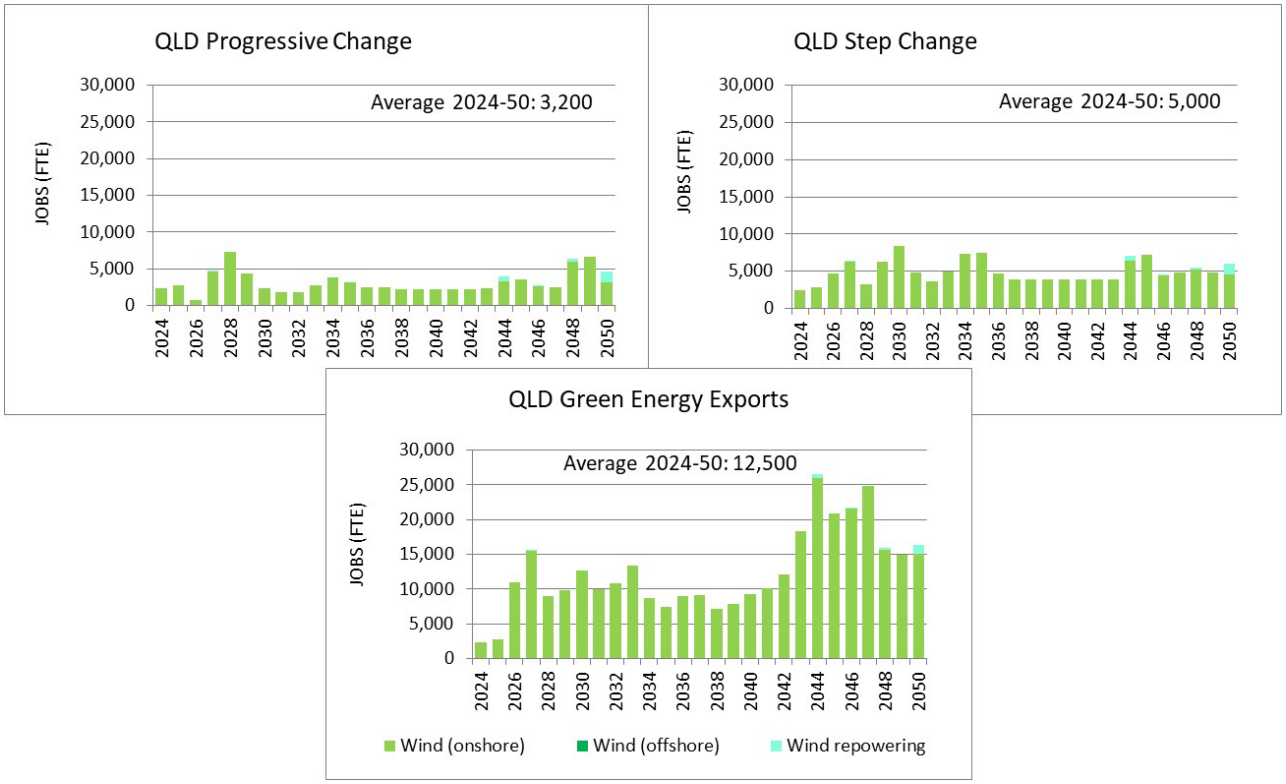

Figure 10 QLD, jobs in wind (all scenarios)

4.2 Utility-scale solar

Utility-scale solar averages 900 jobs between now and 2050 under Progressive Change, 1,600 jobs under Step Change and 8,100 jobs under Green Energy Exports (Figure 11). Under Progressive Change, there is relative stability in the jobs profile, except for minor construction booms in 2034, 2036 and the early 2040s. Under Step Change, demand fluctuates during the 2030s and 2040s, generally between 1,000 and 2,000, with the occasional peak of up to 3,500. Under Green Energy Exports, average employment is 8,100, reflecting the massive expansion in utility solar in this scenario. While peak employment is 40,000 jobs (2050), jobs generally stay between 10,000 and 17,000 after 2040.

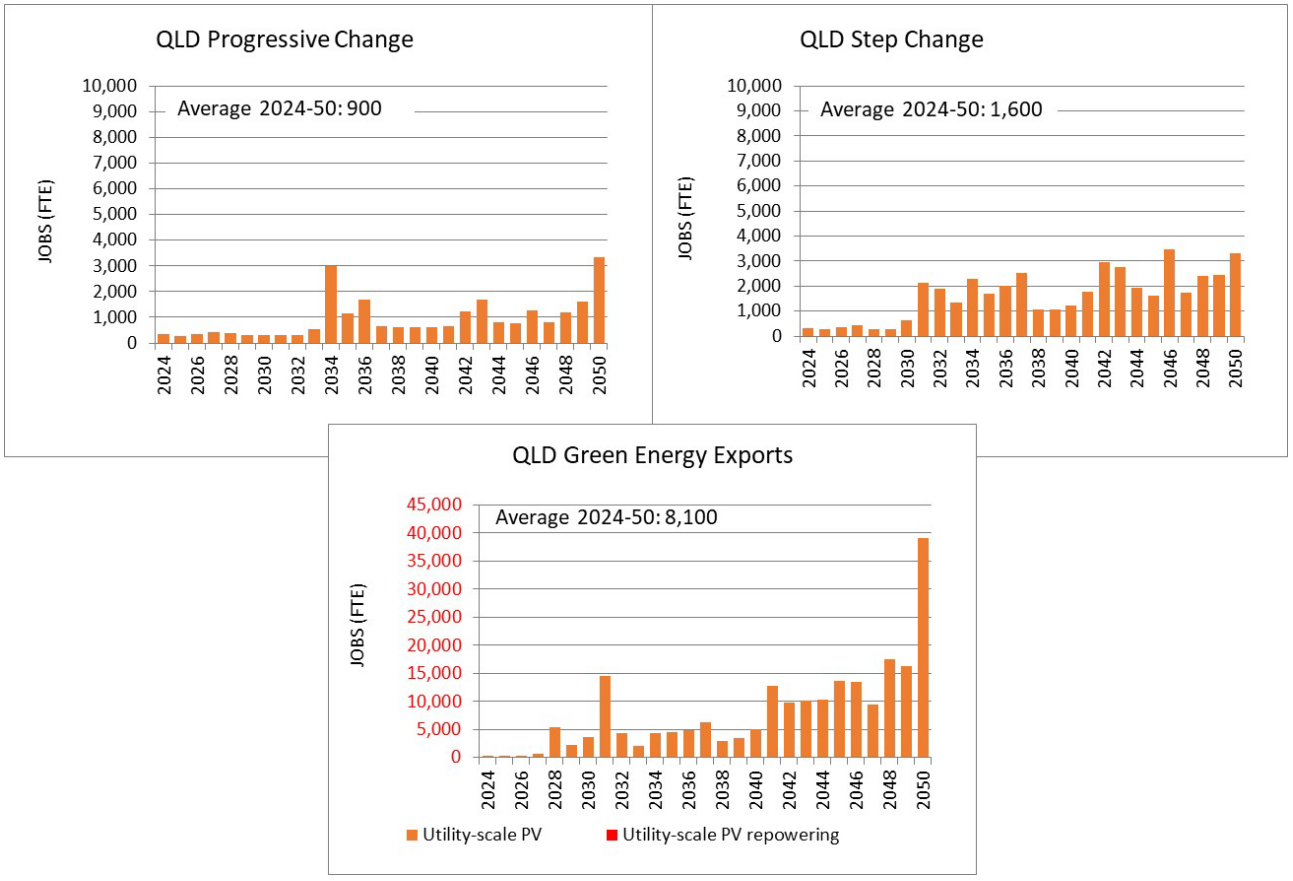

Figure 11 QLD, jobs in utility-scale PV (all scenarios)

Note: Different scale for Green Energy Exports, 0-45,000 (0-10,000 for Progressive Change and Step Change).

4.3 Rooftop solar and distributed batteries

For Queensland, rooftop solar and distributed batteries contribute significant numbers to overall electricity sector employment under all scenarios (Figure 12). Under Progressive Change, an average of 2,300 jobs are in rooftop solar and distributed batteries from now until 2050. Under Step Change, however, this figure more than doubles with an annual average of 5,700 jobs. Green Energy Exports employment is triple that of Progressive Change, with an average of 6,900 jobs. Under all scenarios, repowering of rooftop solar begins to contribute to the overall jobs in the mid-2030s.

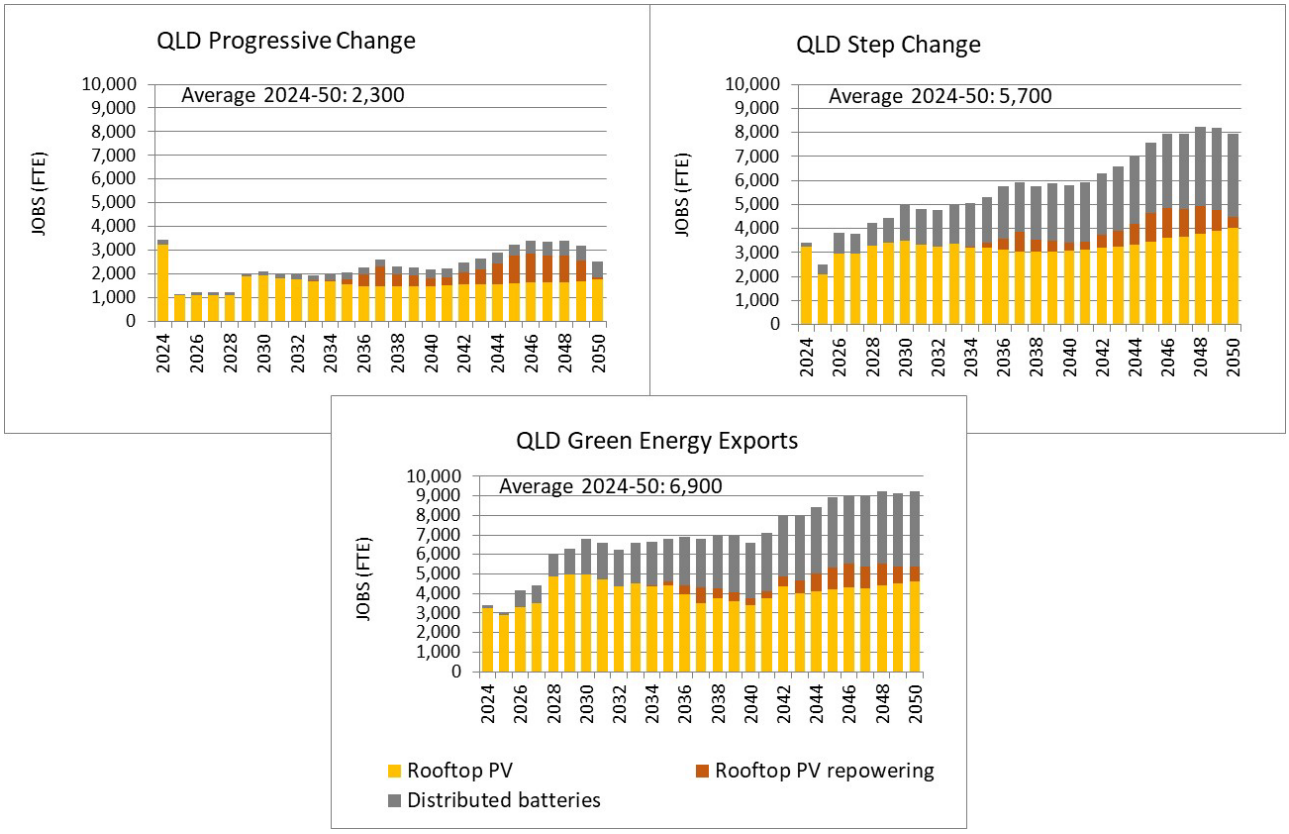

Figure 12 QLD, jobs in rooftop PV and distributed batteries (all scenarios)

4.4 Large-scale storage and hydro

Jobs in large-scale storage, that is utility-scale batteries and pumped hydro, and conventional hydro projects are shown in Figure 13 and Figure 14.

Employment trends in pumped hydro are volatile until 2032 and then become stable, which is indicative of the workforce requirements for construction of the projects. In Progressive Change, there is a further construction period in the late 2040s.

Under all scenarios, jobs in pumped hydro are nearly 4,000 from 2029 through to 2032 during construction, followed by an operations and maintenance workforce close to 200. Under all scenarios, conventional hydro employment has a steady average of 30 jobs.

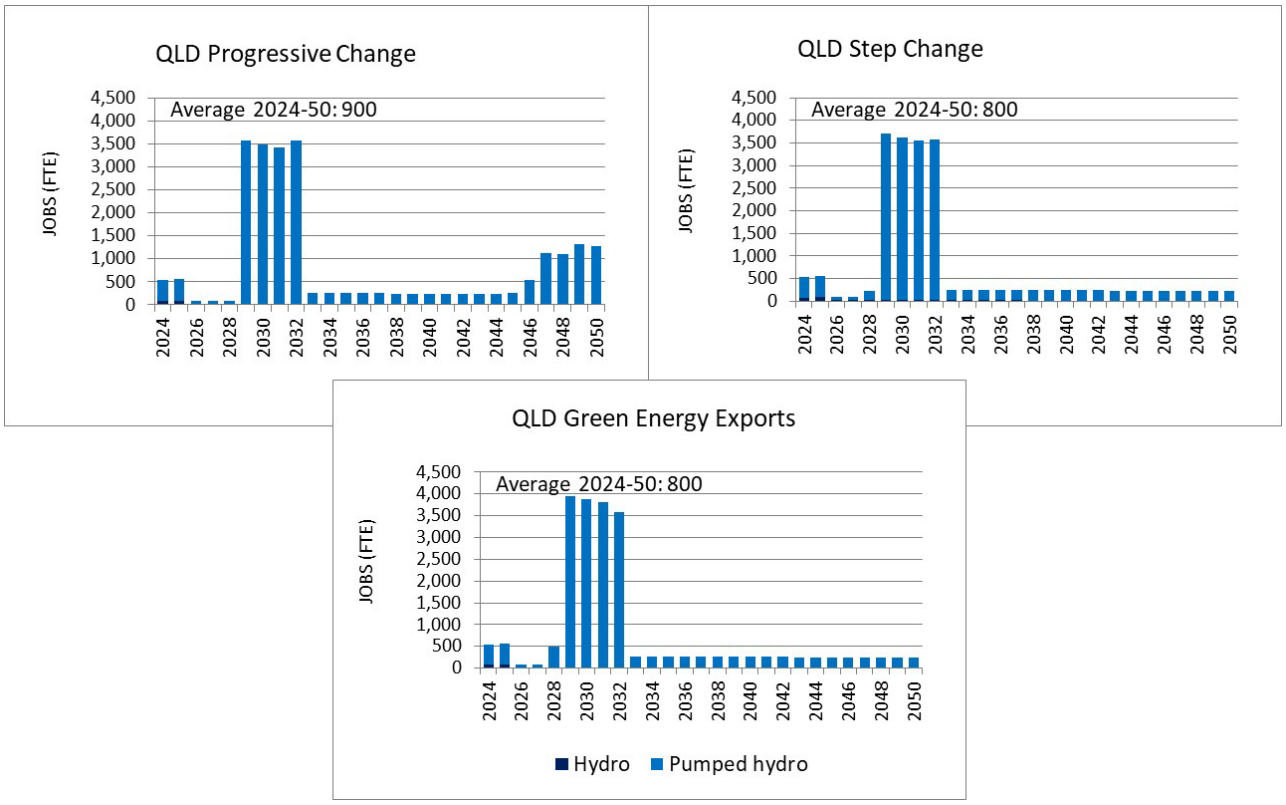

Figure 13 QLD, jobs in hydro (all scenarios)

Utility batteries average 100 jobs from now until 2050 in both Progressive Change and Step Change, with an initial period of higher workforce demand during the late 2020s. Workforce demand doubles under Green Energy Exports, with 200 jobs on average, and a significant peak of just under 1,400 jobs recorded in 2031.

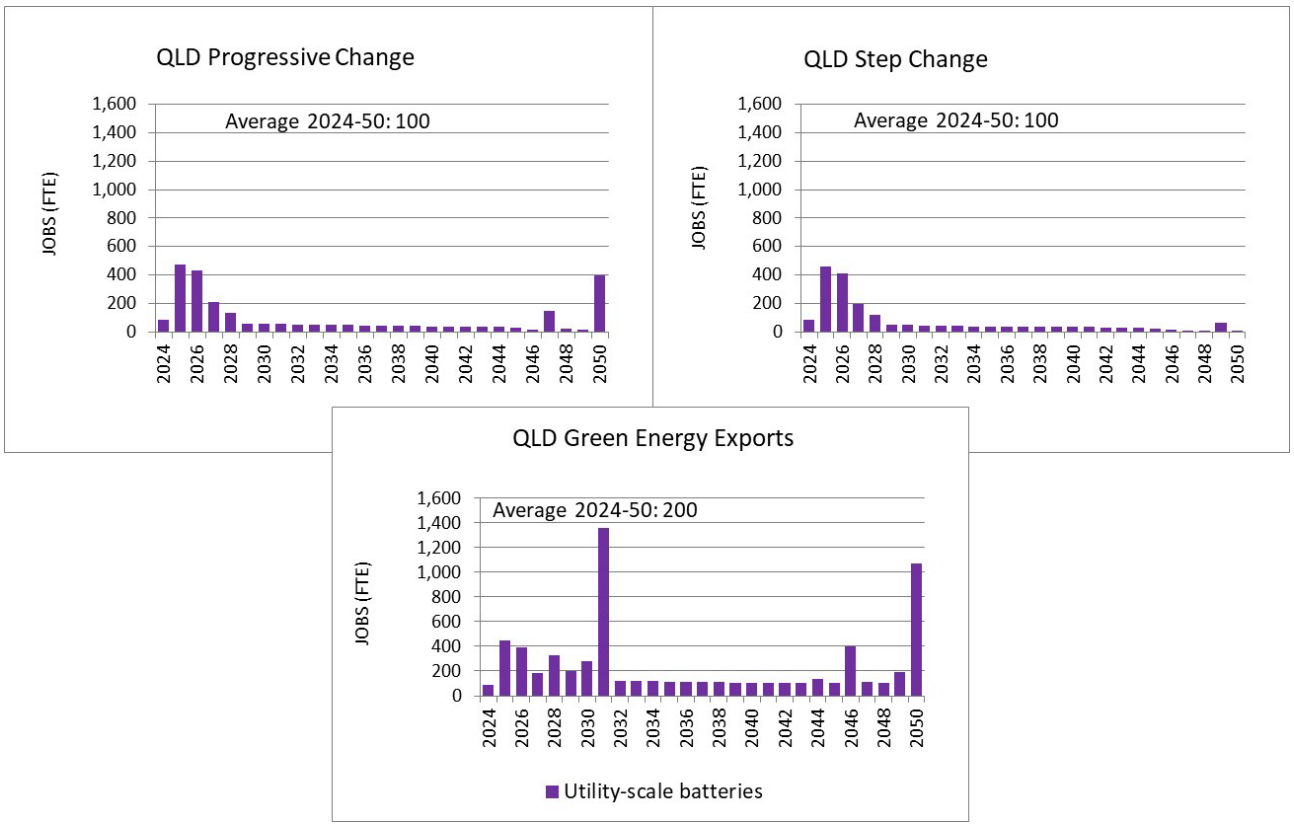

Figure 14 QLD, jobs in utility batteries (all scenarios)

4.5 Transmission construction

Employment for transmission construction[3] in Queensland is shown in Figure 15 for all scenarios. Under Step Change and Progressive Change, the workforce averages between 300 and 500, and peaks at 1,800 in 2029. Under the Green Energy Export scenario, jobs average at 2,400, with construction maintained throughout the period, and peaks in 2029 and 2043.

Under Progressive Change, transmission construction jobs drop to 0 in 2036, while there is another period of construction in the early 2040s in Step Change.

Actual employment in transmission, it should be noted, is likely to be more variable than illustrated here, as these calculations work with the assumption that employment is spread evenly across the construction period for each project.

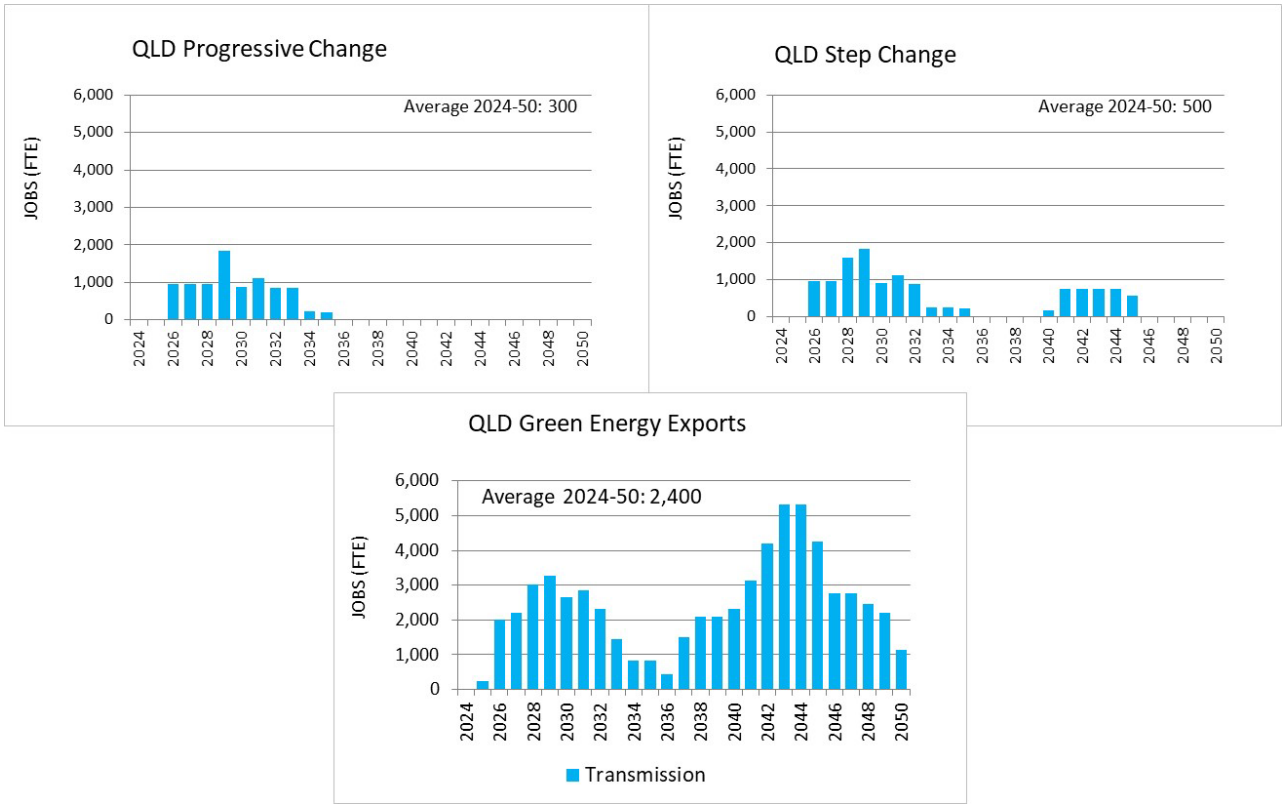

Figure 15 QLD, jobs in transmission (all scenarios)

[3] In this study, only employment in transmission construction is included in projections, as we do not have employment factors for operations and maintenance.

4.6 Coal and gas

Jobs in coal and gas are at approximately 4,000 now and fall to around 1,400 by 2050 in Progressive Change and 800 in Step Change (600 in Green Energy Exports). Jobs in coal account for the greatest share at present, and these are phased out in both Step Change and Green Energy Exports by 2035.

In Progressive Change, coal jobs decline to close to 750 by 2035 and remain there for the rest of the period. Jobs in gas are more variable, peaking at nearly 1,900 in 2042, and averaging 800.

In Step Change, coal jobs decline to 0 by 2035 and gas jobs are both higher and more volatile. They peak at 2,400 in 2043, and average at 1,100 over the period. Under Green Energy Exports, the decline in coal employment is sharper, and less employment is created in gas.

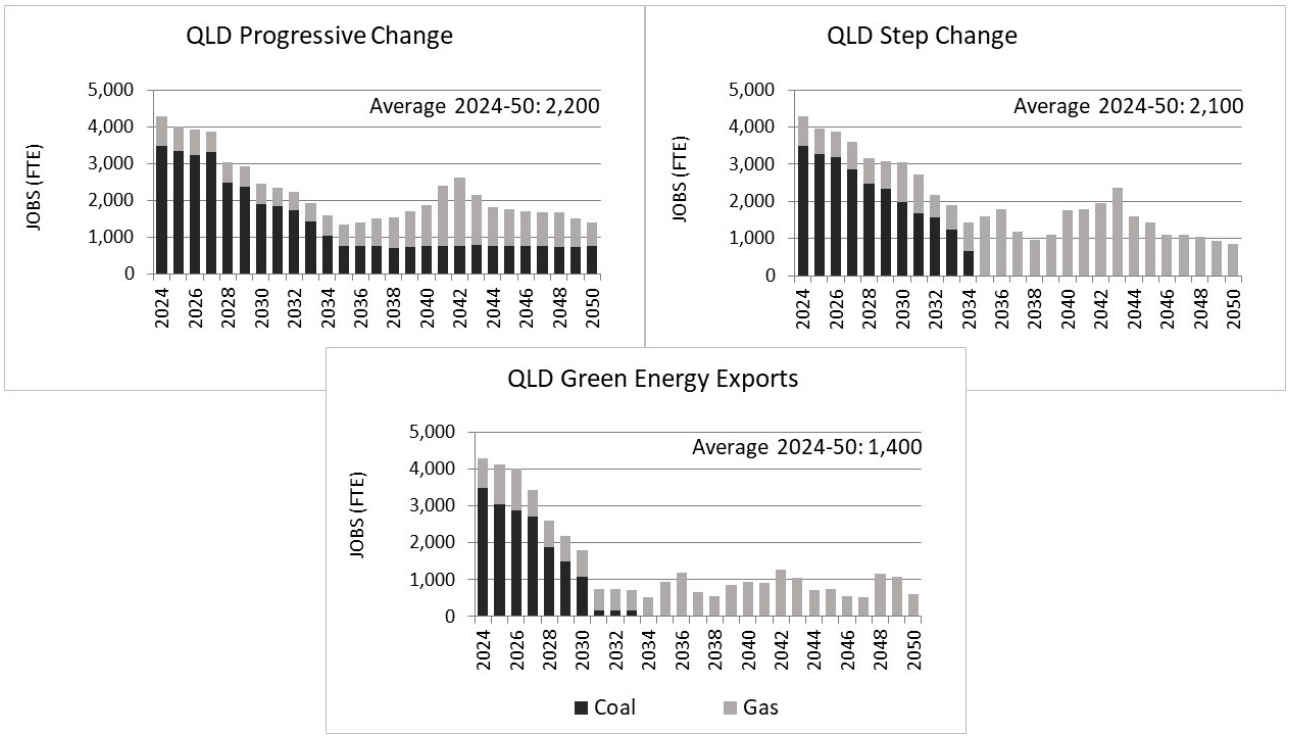

Figure 16 QLD, jobs in coal and gas (all scenarios)

Appendix A Additional information on occupational breakdowns

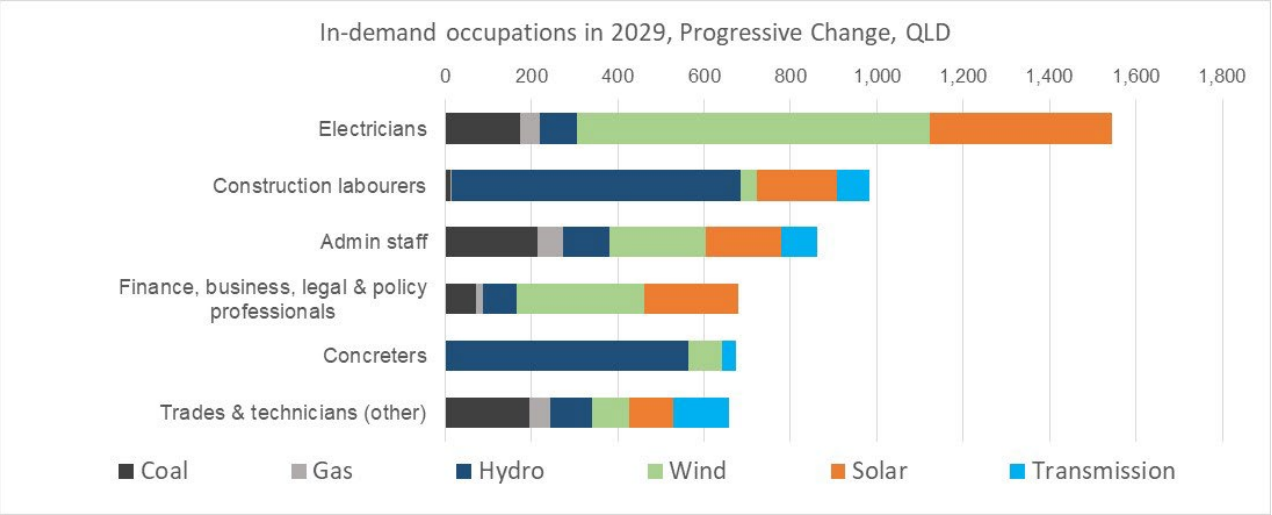

Figure 17 QLD, in-demand occupations during peak year (2029) for Progressive Change

Figure 18 QLD, in-demand occupations annual requirement by technology, Progressive Change

Note: Electricians and admin staff have a scale from 0-2,000 jobs, whereas all other occupations have a scale reaching only 1,200 jobs.

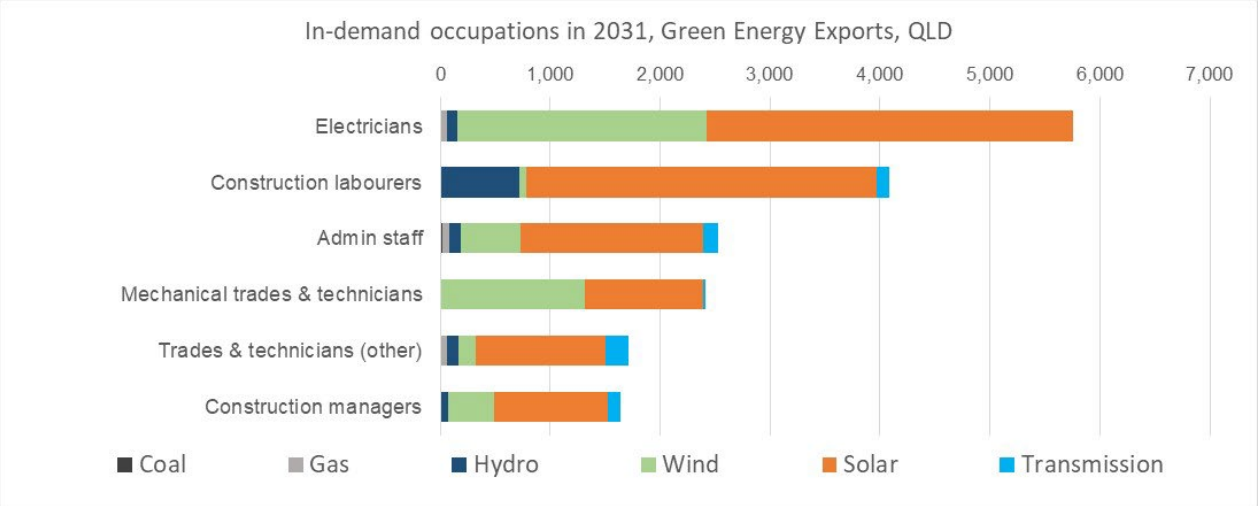

Figure 19 In-demand occupations in 2031, Green Energy Exports, QLD

Figure 20 QLD, in-demand occupations annual requirement by technology, Green Energy Exports

Note: Electricians and admin staff have a scale reaching 7,000 jobs, whereas other occupations have a scale reaching only 4,500.

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